Device at a plate forming tool

The present invention relates to an arrangement in a sheet-metal forming tool according to the pre-characterising clause of claim 1.

Supporting a moveable part in a sheet-metal forming tool by means of a plain bearing or by getting rollers to roll between two plane surfaces was previously known. The said bearings have proved prone to heavy wear and to loss of repeat accuracy, especially in a direction in which they are subjected to the heaviest loading. The environment to which the sheet-metal forming tool is exposed is often dirty, especially in the motor industry. A sheet that is to be formed is in many cases coated with a lubricant with good adhesion properties prior to sheet metal forming and residual lubricant runs into inappropriate places. Particles from the sheet-metal working find their way, among other things, into bearings, where they do not belong. The lubricant sometimes lacks the characteristics of a good bearing lubricant and thereby degrades a film of lubricant present in the bearing when the two lubricants become mixed. A poor lubricating film increases the risk of damage to the bearing. The lubricant also acts as a carrier of the particles that inherently increase the bearing wear and reduce the repeat accuracy. Plain bearing constructions and constructions with two plane surfaces with rollers between them require a large bearing surface in order to function well under high bearing loads. The size of a plain bearing is also determined by the length of a slide movement, which means that the said constructions take up a lot of space.

EP-A1-370 582 shows various types of bearing, for example plain bearing, roller bearing and ball and socket bearing. However, it is not shown how an arrangement capable of solving or at least reducing the problem described above might be produced.

An object of the present invention is to produce an arrangement, which will eliminate or at least reduce the problem described above. This is achieved by an arrangement according to the characterising part of claim 1.

Preferred embodiments have, in addition, any or some of the characteristics specified in the subordinate claims.

The invention will be explained in more detail with the aid of the drawing attached, which illustrates examples of embodiments of the arrangement according to the present invention.

Fig. 1 shows a diagram of an example of the arrangement designed for flanging, in contact with a held sheet.

Fig. 2 shows an example of the arrangement designed for cutting, in contact with a held sheet.

Fig. 3 shows a diagram of an arrangement according to the invention with a drive source exemplified by a hydraulic drive unit.

Fig. 4 describes an example of a sealing arrangement enclosing a part of the wheels in a view looking at the moveable part in figure 3 from below, together with the U-shaped seal inset in the figure, for the sake of clarity.

Fig. 5 shows a diagrammatic section through the moveable part in the preferred embodiment, see section A-A in figure 3.

Fig. 6 shows an example of an alternative embodiment with the wheels located in a part fixed to a stand.

Fig. 7 shows an example of a cut-away diagrammatic view of the first part in an advanced position.

Fig. 8 shows an example of a bearing according to the invention.

Fig. 9 shows an example of a sealing arrangement according to the invention.

Examples of operations, which the arrangement according to the invention is designed to perform, are shown in figure 1 and figure 2. Other operations, which the arrangement is designed to perform and which are not shown in the drawing, include hole-making, for example, the arrangement being especially suited to hole-making where the perpendicular line of the sheet metal does not coincide with the direction of movement of the arrangement.

In figure 1, 1 denotes a held sheet. A first part 2 is designed, during an advancing movement, to flange or form a part of the sheet 1 by means of a sheet-metal forming force obtained from a drive unit 3. Beneath the first part in figure 1 there is a second part 4 fixed to a stand and designed to support the first part 2 by way of a bearing 5. The distance between the parts 2, 4 is small, for example 0.3-3.0 mm. The drive unit, which

in figure 3 is exemplified by a hydraulic unit, may alternatively take the form of a cam unit or roller cam unit (not shown). When a reaction force from the sheet l_1 perpendicular to the direction of movement, occurs on the first part 2, this is absorbed by the bearing 5 and the second part 4 fixed to a stand, which second part can be clearly seen from figure 2. An example of the bearing 5 is shown in figure 8 and comprises a fixed shaft 5b with two rotatably mounted wheels 5a. The wheels 5a are arranged at the ends of the shaft 5b. A pivot bearing 5d is arranged between each wheel 5a and the shaft 5b. A part indicated by 6 is designed to be interchangeable, depending on the current operation.

The peripheral surface of the wheels 5a is hardened and is in contact with a running surface 5c, along which the wheels 5a are designed to run. The radial extent of the wheels 5a between their respective pivot bearings 5d and peripheral surfaces is large enough to ensure that dirt, lubricant and other particles present on the running surfaces 5c can reach the pivot bearings 5d of the wheels 5a only with difficulty. A radial extent greater than the distance between the parts 2, 4, that is approximately 3 mm or more, is to be preferred. In practical trials with two wheels and a simulated sheet metal force of 44 kN a radial extent of 10 mm has proved to work satisfactorily.

A housing 8 surrounds each wheel 5a. Each housing 8 has an opening 10, which faces each running surface 5c. Only a fraction of the wheels 5a protrude out through each opening 10, as is shown in figure 7. The fact that the wheels 5a lie close up to the opening means that dirt, lubricant and other particles cannot easily reach the pivot bearings 5d.

The running surfaces 5c are two surfaces of a hardened sheet metal facing the wheels 5a and the opening 10 and connected to and substantially embedded in the second part 4. The upper surfaces of the second part 4 and the running surfaces 5c lie substantially in the same plane. The sheet 5e and hence also the running surfaces 5c are enclosed by a sealing arrangement 9, which makes it more difficult for dirt, lubricant and other particles to get in between the parts 2, 4 and in between the wheels 5a and the running surfaces 5c and further to the pivot bearings 5d. The arrangement 9 comprises a U-shaped seal 9b and an I-shaped seal 9a. The ends of the I-shaped seal 9a lie close up to the insides of the legs of the U-shaped seal 9b and are designed to run between them. Together with the lower surface of the first part 2 and the upper surface of the second part 4, the two seals 9a, 9b thus form a substantially enclosed space, which surrounds the running surfaces 5c and that part of the wheels 5a that protrudes out of the housing 8.

It will be obvious that the invention can be modified in many ways within the scope of the invention. Thus in an alternative embodiment the shaft 5b is rotatably fixed in the first part 2 and the wheels 5a are firmly mounted on the shaft 5b. In a further embodiment the bearing 5 comprises only one wheel 5a, which is then significantly wider than either of the two wheels 5a. In yet another alternative embodiment a plurality of wheels 5a is arranged on the same shaft 5b or alternatively a plurality of shafts 5b with two wheels 5a, or in a combination of the said embodiments.

In another alternative embodiment the wheels 5a are located in the second part 4, see figure 6, the running surfaces 5c being arranged in the first part 2.

In yet another embodiment just one housing 8 encloses all the wheels 5a.